zudek

english

A little bit of history

Do you want to recover heat and convert it into cold?

With our systems you get the results you want.

The first patent related to a refrigerating machine dates back to the 6th May 1851 and was filed in the name of the US citizen John Gorrie.

Previously, others had manufactured refrigerating machines, such as the Englishman Jacob Perkins, the German Windhausen and the Frenchman Charles Tellier. The machine patented by Gorrie was based on the use of ammonia and developed for commercial purposes to be used mainly on board of ships and trains for the transport of perishable goods.

However, it was Albert Einstein (yes, right him, the Nobel Prize winner!) who in 1930 submitted to the US Patent Office an absorption refrigerator that had no moving parts and required only a heat source to operate.

The Great Depression that severely affected the United States in those years led the refrigerator manufacturers to shelve the Einstein patent to avoid taking the risks related to new entrepreneurial ventures.

As a result of the ban on refrigerant gases, harmful for the stratospheric ozone layer, and of the obligation to reduce greenhouse gas emissions, the interest in Albert Einstein's project is back again.

One of the key features of Einstein's absorption refrigerators was their absolute silentness and durability. In fact, these devices had no moving parts or mechanisms that could be worn out over the time.

However, the most interesting thing was that the refrigerator worked without connection to the power grid.

Today, creating ecological and energy efficient refrigeration systems is essential for our ecosystem.

When we entered the refrigeration market, we noticed that there were only two types of ammonia machines.

The huge ones of the big plants and the very small ones for the refrigerators of recreational vehicles.

Therefore we have thought of creating mid-sized machines ranging from 100 to 700 kilowatts.

In order to thoroughly study this issue we have funded and awarded a PhD program to a pool of engineers.

All the literature and knowledge of the sector has been collected, at least as far as Europe is concerned.

Research and design have taken a long time.

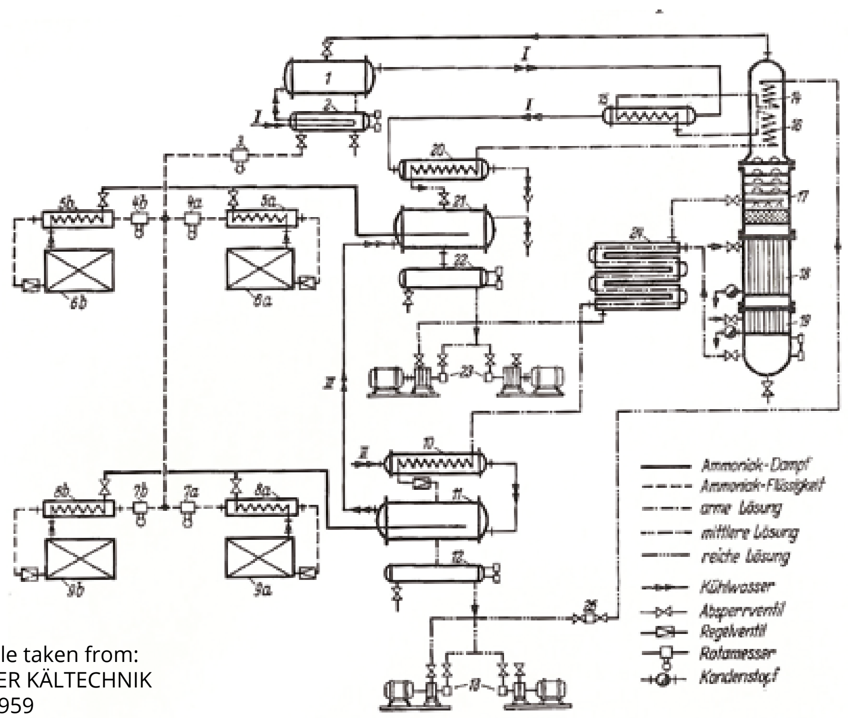
The first plant we built was for Illy, an Italian coffee company, which at the time was already a customer of us.

During product toasting, Illy creates many fumes and develops heat up to 400 degrees.

This heat was dispersed to the air.

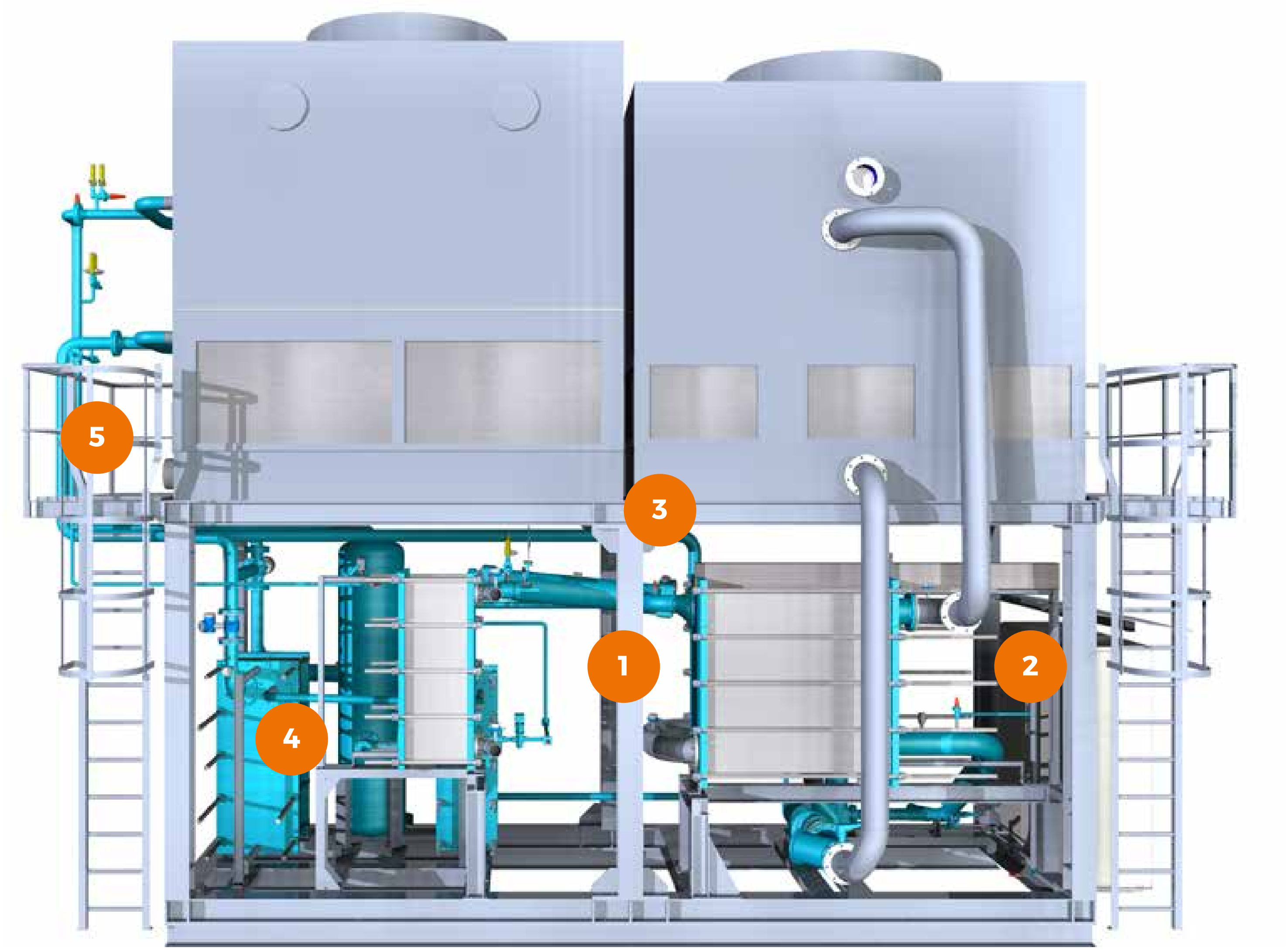
So we built a machine capturing this hot energy, transforming it into water at 95 degrees, which was fed to the ammonia absorber, which in turn created cold power at minus 5/6 degrees.

The project worked!



absorption cycle taken from:
HANDBUCH DER KÄLTECHNIK
Rudolf Plank 1959

strengths



1 cold without electricity

Absorbers exploit heat sources of any kind to generate refrigerating energy. They recover hot process fluids, waste industrial gases, and cogeneration waste.

2 we reinvented hot water

Usually, cogeneration plants meet the high-efficiency cogeneration parameters only by using an absorber.

The new trigeneration plants are built to provide a greater yield and a lower electricity consumption. They produce simultaneously all the energy required by a factory: electric, thermal and refrigeration energy.

3 built to last

Absorbers are designed and built to last under the most extreme conditions for many decades.

4 low maintenance

Being an "oil-free" system with only one pump, maintenance is reduced, thus further lowering plant management costs. Moreover, thanks to our **telematik**® system, absorbers are monitored via telemetry. Our technicians check all the parameters of the machine in real time.

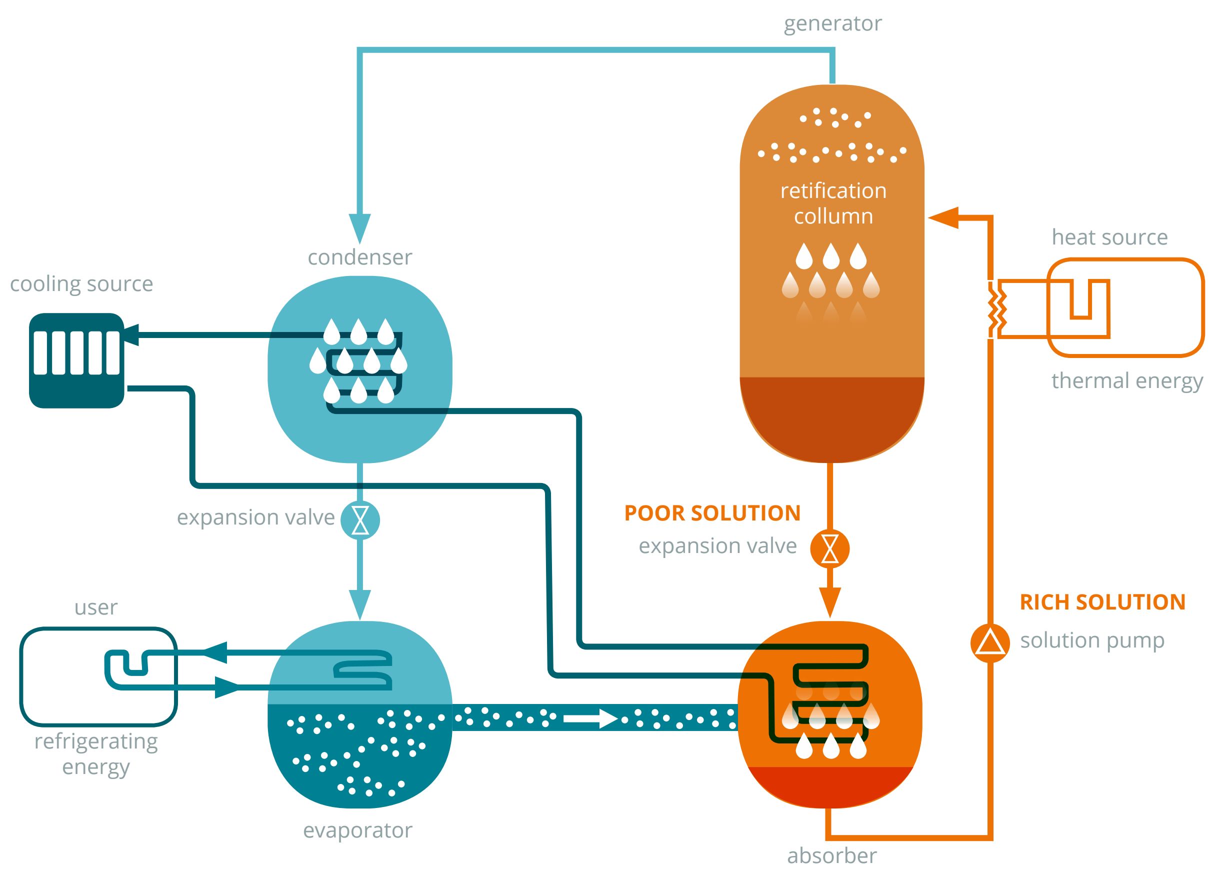
5 ecological

Ammonia is a gas naturally occurring in nature that does not pollute. It is the best refrigerant available on the market.

Our highly technologically advanced systems allow using it at very low loads with an environmental impact equal to zero.

absorption cycle

way of functioning



producing cold without electricity

water/ammonia absorption refrigerating machines produce cooling power from hot thermal energy, unlike what happens in case of compression machines, which use electricity to attain the same result.

ammonia water solution

Ammonia is very soluble in water. It separates from the water with heat and creates a solution if cooled. The absorption cycle makes the most of this feature, being able to provide a cooling function like a traditional refrigeration cycle yet with a minimum energy consumption

operation

For refrigerating units the greater energy consumption is due to bringing the refrigerant from low to high pressure. Using the absorption cycle, ammonia and water are concentrated in the absorber and conveyed under high pressure through a pump.

In the generator, the aqueous solution absorbs heat. Part of the ammonia evaporates and is sent in gaseous form to the condenser, as in a normal refrigeration cycle. Prior to this, ammonia is cleansed by removing any traces of water through an adjustment column, achieving a purity of over 99%. The remaining solution, poor in ammonia, is sent back to the absorber where it is concentrated again.

improving energy performance

Increasing the pressure of a liquid is much cheaper than compressing a gas.

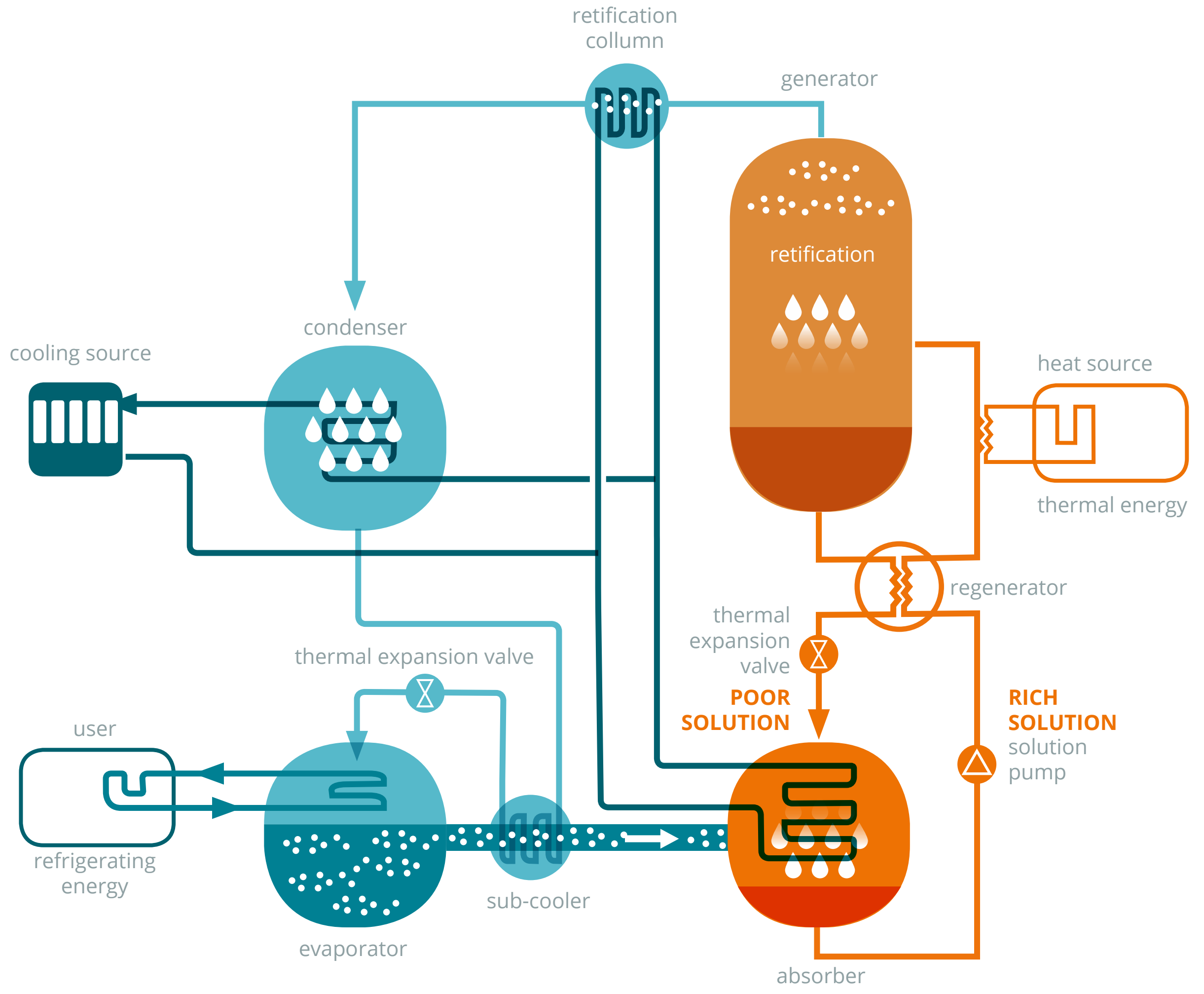
Using the water/ammonia solution pump saves up to 90% of the electrical costs compared to a conventional compressor.

condensing and evaporating the refrigerant

For condensing the refrigerant evaporation towers and condensers or geothermal resources are used. Cooling takes place in the evaporator.

Any kind of fluid can be cooled.

absorption cycle according to Zudek



Zudek has improved the basic refrigeration cycle: low generation temperatures are used and thus a higher thermal recovery is obtained from "colder" and, therefore, more efficient engines

Zudek has added these elements:

regenerator

It preheats the rich solution and cools down the poor solution, with an increase in the COP value.

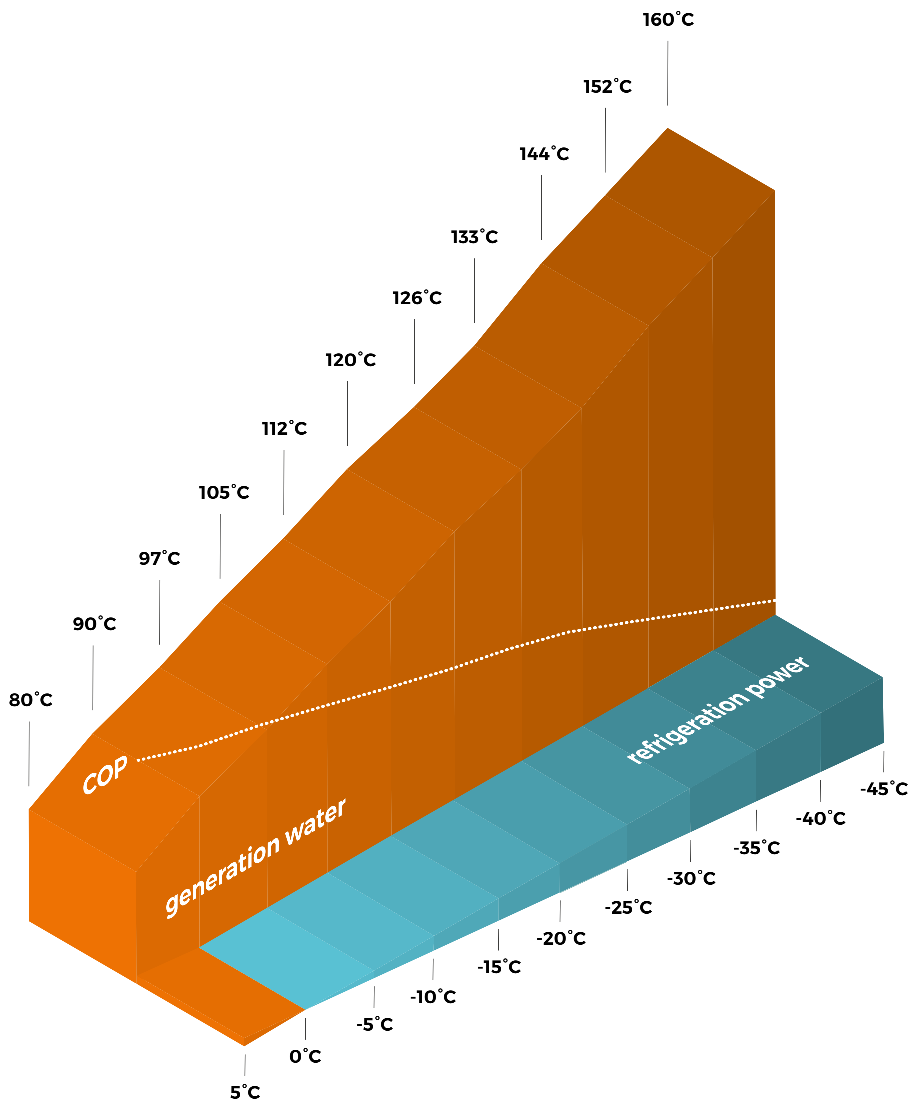
sub-cooler

It cools the condensed ammonia and overheats the refrigerant leaving the evaporator, allowing an increase in the refrigeration energy.

retification collumn

It partially condenses the mixture of water and ammonia by increasing the purity of the refrigerant.

yields and powers



outdoor temperature yield diagram = 25°C

enermatik® HT - high temperatures	
water	+5°C / 0°C H_2O
hot water	+90°C / +80°C
COP	0,58
enermatik® MT - average temperatures	
glycol	-5°C / -10°C
overheated water	+105°C / +95°C
COP	0,5
enermatik® MLT - medium low temperatures	
glycol	-20°C / -25°C
overheated water	+126°C / +116°C
COP	0,42
enermatik® LT - low temperatures	
ammonia	-35°C
overheated water	+144°C / +134°C
COP	0,38

CONAD application with turbo gas machine at -8°C for logistics hubs

Conad, namely the Logistics hub of Fiano Romano, called us to solve an energy saving issue. The Fiano Logistics Hub serves the Lazio region and the surrounding regions.

Conad is a very green and ecological company.

They want to waste less electricity and use as much natural resources as possible.

For now, they produce electricity using photovoltaic solutions and turbines, but this is not enough.

They would like to be able to exploit the heat wasted by the turbines, which is currently being dispersed, and convert it into refrigeration energy sub zero.

We have designed a plant that uses turbine exhaust fumes, ranging from 240 to 120 degrees. The plant produces hot water at 115 degrees feeding our absorber, which, in turn, generates refrigeration energy at minus 8 degrees.

The advantages of this solution are three:

- a global plant yield of over 80%
- totally free refrigeration energy
- cost savings that allow the plant to be repaid in two years.

Technical data

enermatik® MT - average temperatures

		fluid	temperature
refrigeration power	360 kW	glycol	-8 °C
thermal power	720 kW	glycol	+115/+105 °C
COP	0,5		

Salumificio VITALI application with turbo gas

machine at -5°C with improved efficiency

Salumificio Vitali is located on the Modena hills and produces an excellent raw ham.

It has expanded its factory with reference to both the production and the curing area.

Hams curing, right because of the time it takes, requires a remarkable energy load.

Salumificio Vitali needs electric energy, thermal energy for washing the hams, and refrigeration energy for drying and curing.

The ham, from the production till the end of the curing, undergoes a weight loss of about 30%.

Drying of the product is attained by heating and cooling the air so that humidity present inside the ham comes out. After several months of this treatment the hams are cured.

In order to produce the required energy in-house, Vitali has decided to use methane gas at the plant.

Therefore, they contacted us to ask us information about our trigeneration plants.

Our Enermatik plants can produce the three types of energy they need simultaneously: electrical energy, thermal energy, refrigeration energy. Moreover, they ensure a remarkable energy saving.

After a careful design study and several on-site inspections, we decided to install a methane-powered turbine. By turning, the turbine generates electricity and thermal energy. Thermal energy is partially used for "washing" the hams where high temperature water is required, and partially converted into water chilled to minus 5 degrees, which is used for drying and curing.

Oh yeah, the difference, in the end, assures energy saving!

Technical data

enermatik® MT - average temperatures

		fluid	temperature
refrigeration power	110 kW	glycol	-5 °C
thermal power	240 kW	water	+103/+93 °C
COP	0,45		

GIAS application with endothermic engine machine at -35°C for quick-freezing

Cefla is a company based in Imola, Italy, that produces cogeneration plants.

Among its customers there is Gias SpA, a large company that provides quick-freezing services for food and vegetables on behalf of third parties, which was established 30 years ago.

Over the years this big industry has increased and expanded its production and product portfolio and, consequently, the storage space for food.

They need a lot of electricity. The available one is not enough and, therefore, they are forced to produce it.

Cefla has provided them with a cogeneration plant, fed using methane gas, which produces about 4 megawatts of energy.

The plant generates considerable "waste heat" that is dispersed.

Therefore, they have asked us if we can recover such waste heat and turn it into refrigeration energy.

We have designed a plant that collects this precious heat at 170 degrees and transforms it into refrigeration energy.

We are going to supply them with a water and ammonia absorber that produces cold at minus 35 degrees i.e. the cold required by Gias for quick-freezing and preserving the products.

The yield of this plant exploits over 90% of the energy production, while normally, it is not possible to exceed 50%.

Technical data

enermatik® LT - low temperatures

		fluid	temperature
refrigeration power	280 kW	ammonia	-35 °C
thermal power	760 kW	water	+170/+160 °C
COP	0,37		

PRAMSTRAHLER application with syngas engine

low temperature generation machine

This is a South Tyrol company established in 1945, which processes pork meat to produce speck ham, wurst, hams and other specialties.

And, as the motto concerning pork goes... "nothing is throw away".

Therefore, they want to recover the heat from the fumes of their processing plants in order to produce energy in-house.

They have decided to install a cogeneration plant using wood chips - of which they have plenty - to feed a "pyrogasification plant", which in turn produces Syngas (synthesis gas).

This Syngas feeds an endothermic engine.

Such endothermic engine must necessarily be cooled in order to work properly. From this cooling it is possible to recover the heat of the fumes, of the sheaths, as well as that of the oil circuit.

At the end of the path, the heat power that can be recovered is low, around 95 degrees.

Our challenge was to build an absorber that could work well even at 95 degree of temperature by cooling glycol to minus 8 degrees.

We have studied this case for a long time, prepared a design and created a machine that can work even at not very high temperatures.

In this way, thanks to our absorber, we could close the heat recovery cycle.

Technical data

enermatik® MT - average temperatures

		fluid	temperature
refrigeration power	315 kW	glycol	- 8°C
thermal power	700 kW	water	+95/+85 °C
COP	0,45		

ILLY
heat recovery machine at -2°C for dehumidification

More and more companies are forced to self-generate electricity because the one that is generally provided is not enough.

Of course, it would be ideal to use clean energies such as wind, photovoltaic or hydroelectric power but, due to a number of factors, this is not always possible and also these energy sources are not enough.

Generally, energy production takes place using compression engines or turbines.

These engines are fueled by methane.

Compression engines feature an energy efficiency of 45% while turbines of 30%.

The rest is heat that is dispersed in the air along with other pollutants.

This, besides representing a waste, overheats and makes the Earth's atmosphere worse.

For years we have been studying how to recover heat and turn it into refrigeration energy from 0 degrees downwards, using ammonia, a gas naturally occurring in nature that does not pollute.

The first plant we built was for Illy, an Italian coffee company.

Illy wanted to recover the heat produced by its coffee roasting processes.

Processing fumes develop heat up to 400 degrees - heat that was dispersed in the air.

Therefore, we built an ammonia absorber that captured the hot energy and turned it into cold power at minus 2 degrees.

The entire Illy plant, i.e. the production part and the rest, benefited from it at no extra cost.

Technical data

enermatik® MT - average temperatures		
refrigeration power	48 kW	**glycol -2°C**
thermal power	100 kW	**water +95/+85°C**
COP	0,48	

absorption refrigeration plants with trigeneration
"tailor-made suits"

design

For the three-dimensional design step we use technologies that allow us to show how the finished plant will look like virtually. In this way we optimize the production process and the quality of the final product.

construction

We supply components, produce refrigeration plants, create electrical systems, install the safety plants and systems, share with our customers the performance of the assembly, final testing and maintenance operations.

installation

The plant is supplied as a "turnkey" solution. Delivered, installed and tested at the customer premises.

management

Our management software regulates the machine as an expert refrigeration engineer. It always gets the maximum COP. It checks the refrigerant charge and verifies the quality of the power supply continuously.

telemetry

All machines and plants can offer telemetry supervision and monitoring. Thanks to this service, the technicians can control, in real time, the machine parameters allowing remote adjustment and assistance.

maintenance

Our machines are designed and built to last for many decades under the most extreme conditions.

Being "oil-free" systems with only one pump, maintenance is minimized, thus further lowering plant management costs.

your notes

We love creating tailor-made suits.

If you do not find your solution here, please call us.

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